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ABSTRACT

This paper describes the nature of stimulus and response generalization and identifies a number of tasks related to generalization that are commonly taught in early childhood programs. Substantial research has demonstrated that stimulus generalization does not occur automatically and it can often be achieved only as a result of special programing. It is imperative that early childhood educators actively employ specialized techniques to enhance generalization of learning and assess the functional application of skills in commonly occurring conditions in natural environments. Response generalization is of particular concern in early childhood education, as a number of readiness, preacademic, prerequisite, and generic skill training tasks are commonly included in early childhood curricula. In terms of readiness, these skills are beneficial only if they undergo response generalization, that is, if they change the form in which they are performed in academic tasks or other functional activities in the natural environment. If response generalization does not occur, children who are taught generic readiness responses will not benefit from instruction. Since specialized techniques for enhancing response generalization have not been reported in the literature, the most efficient course would be to teach functional tasks in the form in which they must be performed in the natural environment. (RH)

Generalization of Learning: An Essential Consideration in Early Childhood Education

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Abstract

Substantial research indicates that generalization of learning does not occur automatically and that special techniques are frequently required to promote skill generalization. Particular problems with generalization have been observed among readiness, preacademic, prerequisite, and generic skill training tasks that are common to early childhood curricula. The paper describes the nature of stimulus and response generalization, and identifies a number of related tasks that are commonly taught in early childhood programs. Related research evidence concerning generalization is reported. Recommendations for enhancing generalization are made.

Generalization of Learning: An Essential Consideration in Early Childhood Education

What is Generalization and Why is it An Essential Consideration in Early Childhood Education?

Generalization. There are two types of generalization: stimulus generalization and response generalization. Stimulus generalization occurs when a response (e.g., adding two numbers), trained under one set of conditions (e.g., in a classroom workbook), is performed in essentially the same manner under a different set of conditions (e.g., at a candy counter).

Technical note: the student may have to adapt the response to the demands of each set of conditions to which the response is generalized. For example, addition of two numbers using paper and pencil in a workbook, may be performed in a different manner than adding candies at a candy counter; however, essentially the same response is being performed in each set of conditions. Response generalization occurs when the training of one response (e.g., copying dot-to-dot patterns) affects the performance of other different responses (e.g., letter resequencing errors in reading).

Why generalization is an essential concern in early childhood education. Stimulus generalization is a concern where instruction occurs under conditions that are different from those in which a response being taught is eventually expected to be performed. Frequently the instructional conditions in classrooms (e.g., paper and pencil tasks in workbooks) are substantially different from conditions in the natural environment where children are eventually expected to perform. According to a recent report by the National Association for the Education for Young Children (Bredekamp, 1987), in early childhood education, there has been an over-emphasis on achievement of narrowly defined academic skills, paper and pencil exercises and worksheets, such as circling items on worksheets and drilling with flashcards. The curriculum has been narrowly focussed on

discreet, technical, academic skills without recognition that all areas of children's development are interrelated (Bredekemp, 1987).

Academic skills are a means rather than an end. In general, academic skills are useful only when employed in a functional application. Academic skills must be highly generalized across domains. For example, computation skills must be applied in instances that may be very different from traditional teaching formats, and in many cases, two or more operations are used in succession to solve the same problem. For example, a child wanting to spend one dollar at a candy counter may have considerable difficulty determining how many of each of two items ("A" sells for .10 each; "B" sells for .25 each) he/she can get without exceeding one dollar. Such problems present themselves in very different formats from those encountered in classrooms, such as math problems on the chalk board or on a ditto sheet. Thus, instruction in academics should be designed to facilitate generalization to "real-life" situations (Wolery & Brookfield-Norman, 1988). Educators have not been overly concerned with determining whether school-related skills generalize to real-life situations (Royer, 1979).

Stimulus generalization is also a concern where, as is the usual case, it is impossible to teach a child to perform under all possible conditions that might arise. In this situation, the child must be taught to perform under one or more representative conditions with the expectation that his/her newly learned responses will generalize to other conditions in which the response would be appropriate.

Generalization is perhaps, the most important phase of learning (Fischer & Farrar, 1987; Haring, 1988). The goal of all education is that students be able to successfully apply what they have learned to commonly occurring conditions in natural environments and that they adapt to novel situations that are likely to arise (Haring, 1988).

Response generalization is a concern when one response is considered to be a readiness skill or a prerequisite (e.g., a *pre*-reading skill) for another response, or where a *generic skill* (e.g., the visual perceptual skills associated with picture puzzle construction: color, form, orientation and shape discrimination) are expected to generalize to a variety of different tasks requiring the same subskills (e.g., letter and word discrimination). A number of readiness, preacademic, "prerequisite" and generic skill training tasks are commonly included in early childhood curricula, for example: building a tower of blocks; putting pegs in a pegboard; reproducing repeated patterns of beads; completing interlocking picture puzzles, and putting nesting cups together. These tasks teach a variety of generic skills such as finger dexterity, eye-hand coordination, and color, shape and size discrimination, common to a broad variety of tasks. However, in the natural environment, there is very little demand for performance of these skills in the form in which they are taught. In terms of readiness, these skills are beneficial only if they undergo response generalization, that is change the form in which they are performed in academic tasks or in other functional activities in the natural environment. Carr (1988) wrote that seldom do we wish to change only a single behavior. Instead, we hope that by intervening on one class of behaviors, other classes of behaviors that have not been the target of intervention will also change in a desired direction.

The National Association for the Education of Young Children report (Bredekamp,1987) recommended that early childhood programs should be developmentally appropriate, meaning that curricula should be developed on the basis of normative developmental sequences. "Knowledge of typical development of children within the age span served by the program provides a framework from which teachers prepare the learning environment and plan appropriate experiences" (Bredekamp, 1987, p.2). However, selection of instructional targets on the basis of tasks listed on normative

scales of development may result in the teaching of skills that are normative, but educationally irrelevant (Garwood, 1982), for example, walking backwards, heel-to-toe; building a pyramid of ten blocks in imitation; imitating motor activities, such as hands up, hands on shoulders, touch toes, etc. None of these tasks are functional; none of the tasks are commonly required in the natural environment. Learning to perform these tasks is of no benefit unless the subskills acquired are generalized and adapted to produce an improvement in the performance of functional activities. Many curricula appear to be mere expansions of assessment items taken from normative developmental schedules without careful thought having been given to determining which items are and which are not educationally relevant. Considerable time can be lost teaching skills that are educationally irrelevant (Garwood, 1982).

Bailey and Wolery (1984) have described several problems associated with building an early childhood curriculum on the basis of a developmental model of child development. One problem described is that developmental milestones are not necessarily good instructional targets. The original purpose of establishing developmental milestones was to differentiate between different ages, not to serve as indicators of the best skills to teach young children. For example, in spite of the fact that the ability to stack blocks may be useful for determining a child's developmental age, it does not necessarily mean that time should be spent teaching a child who cannot perform the task to stack blocks; that skill alone may not be very useful to the child (Bailey & Wolery, 1984).

Does Generalization Occur?

Stimulus generalization. After reviewing 270 studies relating to generalization of learning a broad variety of skills acquired by a diversity of learners, Stokes and Baer (1977) concluded that generalization does not occur automatically and that it can be achieved only as a result of special programming. Sub-

stantial evidence indicates that the greater the number and type of differences between two sets of conditions (e.g., instructional conditions and natural conditions), the less likely a response will generalize from one set of conditions to the other.

Response generalization. In the past, under the belief that it would develop readiness for reading, kindergarten children were taught to hop and skip, cut with scissors, name the colors, and tell the difference between circles and squares. These may be worthwhile activities for four- and five-year olds, but skill in doing them has a negligible relationship with learning to read. There are schools, nonetheless, that still use reading readiness checklists that assess kicking a ball, skipping, or hopping. Thus, reading instruction is delayed for some children because they have failed to master physical skills or other skills with a doubtful relationship to reading. (Anderson, Hiebert, Scott, & Wilkinson, 1985).

In 1973, Hammill and Wiederholt reviewed a number of studies in which the Frostig Program of Visual Perception (Frostig & Horne, 1964) had been used to train generic, readiness and preacademic skills to improve reading, printing and writing by children in kindergarten, grade one and above. Many of the observations made in this review may also be made in contemporary early childhood programs. In the Frostig program, children practiced a) eye-hand coordination by drawing curved, straight and angled lines; b) figure-ground perception by finding and tracing geometric figures embedded in other geometric patterns; c) recognition and discrimination of geometric figures presented in a variety of sizes, shadings, textures and positions; d) discrimination of rotations and reversals of rows of similar figures and e) copying complex geometric figures. In 11 out of 12 studies reviewed, the authors concluded that any improvements that may have happened in the skills taught did not result in any significant improvement in reading; the skills did not generalize

(Hammill & Wiederholt, 1973). The consensus reached by researchers is that the Frostig-Horne approach will not affect the reading ability of children in any way, and may be of no value or limited value in improving perception in children. The use of perceptual activities with children has not been demonstrated to produce better school performance; considerable evidence has accumulated that this approach has little or possibly no educational value (Hammill, 1982; Hammill & Wiederholt, 1973; Kavale, 1984; Myers & Hammill, 1982). Similarly, reviews of a number of studies attempting to improve perception of the sequential pattern of letters in words by having children repeat various patterns of small, medium and large blocks or dominoes with one, two, or three dots; from memory, copy sequences on a pegboard, or copy bodily movements (e.g., touch-knees-head-shoulders, clap hands, jump and bend) have had no beneficial effect (Hammill & Larsen, 1974). Response generalization did not occur .

The greater the number and type of differences between two classes of responses, (e.g., the number of subskills they have in common, and the manner in which the subskills are performed) the less likely improvements in the performance in one class of tasks will generalize to the other class of tasks.

A <u>task domain</u> refers to a set of tasks that involve small variations in each other; they are tasks that have many subskills in common. When tasks differ, the subskills required may differ substantially, and consequently the course of generalization is much less predictable. Development of tasks within a domain is more coherent and systematic than development of tasks across domains. The skills required to perform in one domain typically comprise only a subset of the skills required to successfully perform in another domain (Fischer & Farrar, 1987). In essence, what Fischer and Farrar have acknowledged is that response generalization is much less common and predictable than is stimulus generalization.

Piaget and response generalization. In the field of cognitive development, most depictions of stages (such as Piaget's concrete operational stage) assume that the stage characterizes a person's thinking across a large number of tasks (Feldman, 1980; Fischer, 1980; Piaget, 1957, 1971, 1983). The assumption is that the ability to perform concrete operations emerges at about 7 years of age and quickly generalizes across domains (Fischer & Farrar, 1987). However, when subjects are given multiple tasks requiring the same operations (e.g, various tasks involving conservation), the assumption of widespread generality of the stage (that response generalization has taken place) is usually not upheld. For example, a child who understands that a tall, thin (eight ounce) glass has the same amount of orangeade as a short, fat (eight ounce) glass, (conservation of continuous quantities) may not understand that a ball of plasticine made into a "pancake" retains the same amount of plasticine (conservation of quantity). The ability to perform the same task with different materials often appears at different ages (Brainerd, 1978; Feldman, 1980; Fischer, 1980; Reese, 1977; Rogoff & Gauvain, 1984; Siegler, 1981). In these situations, response generalization has not occurred.

Fischer and Farrar (1987) reported that, according to hundreds of studies, a child functions at different skill levels for different tasks and contexts (e.g., Biggs & Collis, 1982; Fischer & Lamborn, 1989; Flavell, 1982). In this sense, the failure of a skill (e.g., conservation of number) to generalize across tasks at the same stage (e.g., conservation of mass) is the rule rather than the exception in cognitive development (Fischer & Farrar, 1987). Generalization is one of the most fundamental problems in cognitive science (Fischer & Farrar, 1987)

Generalization is related to intelligence. When extremely intelligent children develop a new capacity, they seem to apply it more quickly across domains than do ordinary children. For example, when they acquire concrete operations, children of normal

intelligence show it initially in only a limited set of tasks. Extremely intelligent children, on the other hand, quickly show it across many tasks (Brown, 1973; Lovell & Shields, 1967; Roberts, 1981; Webb, 1974). The problem of skill generalization has become a central issue in special and remedial education programming and research during the past decade (Ellis, Lenz & Sabornie, 1987). For example, a major research study of the problems and procedures of generalization has been established at the University of Washington (Haring, 1988)

Summary and Recommendations

Stimulus generalization. Substantial research, conducted on a broad variety of learners and tasks has demonstrated that stimulus generalization (occurring when a response trained under one set of conditions is performed in essentially the same manner under a different set of conditions) does not occur automatically and that, frequently, stimulus generalization can be achieved only as a result of special programming. The goal of all education is that students be able to successfully apply what they have learned to commonly occurring conditions in the natural environment and that they be able to adapt to novel situations that are likely to arise. Frequently, the instructional conditions in classrooms (e.g., paper and pencil tasks in workbooks) are substantially different from conditions in the natural environment where children are eventually expected to perform. Instruction in academics should be designed to facilitate generalization of skills to "real-life" situations. (Wolery and Brookfield-Norman, 1988). Therefore, it is imperative that early childhood educators actively employ specialized techniques to enhance generalization of learning. and assess the functional application of skills in commonly occurring conditions in natural environments. Specialized techniques for enhancing generalization have been described in various publications (e.g., Baine, 1986; Haring, 1988; Horner, Dunlap & Koegel, 1988; Stokes & Baer, 1977;

Response generalization. Response generalization (when one response is considered to be a readiness skill or a prerequisite for another response or where a generic skill, e.g., visual perceptual skills, are expected to generalize to a variety of different tasks requiring the same subskills) is much less common and predictable than is stimulus generalization. Response generalization is of particular concern in early childhood education as a number of readiness, preacademic, "prerequisite" and generic skill, training tasks are commonly included in early childhood curricula, for example: building a tower of blocks; putting pegs in a pegboard; reproducing repeated patterns of beads; completing interlocking picture puzzles, and putting nesting cups together. There is nothing intrinsically wrong with teaching children to perform these tasks. These tasks teach a variety of generic skills such as finger dexterity, eye-hand coordination, and color, shape and size discrimination, common to a broad variety of tasks. However, in the natural environment, there is very little demand for performance of these skills in the form in which they are taught. In terms of readiness, these skills are beneficial only if they undergo response generalization, that is, change the form in which they are performed in academic tasks or in other functional activities in the natural environment. If response generalization does not occur, children taught generic readiness responses will not have benefitted from instruction.

Specialized techniques for enhancing response generalization have not been reported in the literature. In the absence of specialized techniques, it is difficult to improve response generalization. Therefore, rather than teach readiness, prerequisite or generic tasks that are dependent upon response generalization, it would be more effective and efficient to teach functional tasks in the form in which they must be performed in the natural environment; in which case, response generalization would not be necessary.

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